REMARKS

The application has been reviewed in light of the Office Action dated January 5, 2007. Claims 1-11 were pending. By this Amendment, claim 10 has been canceled, without prejudice or disclaimer, claim 1 has been amended to include the features formerly recited in now-canceled claim 10, 9 has been amended by rewriting the claim in independent form, and new dependent claims 12 and 13 have been added. Accordingly, claims 1-9 and 11-13 are now pending, with claims 1 and 9 being in independent form.

Claims 1, 2 and 6-9 were rejected under 35 U.S.C. § 102(e) as purportedly anticipated by U.S. Patent No. 6,690,961 to Kaufman et al. Claims 3 and 4 were rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Kaufman. Claim 5 was rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Kaufman in view of WO 02/04970 (Geraats et al.). Claims 10 and 11 were rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Kaufman in view of Geraats.

Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claims 1 and 9 are patentable over the cited art, for at least the following reasons.

It is contended in the Office Action that the means elements in claims 1-3, 6 and 8 are not specifically defined in the written description.

Applicant brings to the Examiner's attention the following information regarding the means elements: imaging means corresponds to imaging processing section 81 and imaging control section 82, as discussed, for example, at page 8, line 27 through page 9, line 15, and shown in Fig. 1; signal processing means corresponds to signal processing unit 7, as discussed,

for example, at page 7, line 20 through page 9, line 5, and shown in Fig. 1; display means corresponds to display 20, as discussed, for example, at page 8, line 27 through page 9, line 5, and shown in Fig. 1; control means corresponds to CPU 8, as discussed, for example, at page 7, lines 23-25, and page 8, line 27 through page 9, line 5, and shown in Fig. 1; mode switching means corresponds to input means 21 in manual mode, as discussed, for example, at page 11, lines 6-12, and to CPU 8 and signal processing unit 7 in automatic mode, as discussed, for example, at page 11, lines 13-23); means for extracting reference data corresponds to CPU 8 or signal processing unit 7, as discussed, for example, at page 15, line 20 through page 16, line 28; and input means corresponds to input means 21, as discussed, for example, at page 11, lines 10-12)

This application relates to a magnetic resonance imaging (MRI) apparatus for obtaining a desired tomogram of an object to be examined by utilizing nuclear magnetic resonance (NMR), and a technique for determining an accurate time of starting a measurement after injection of a contrast agent when blood vessel imaging is performed in the MRI apparatus.

Applicant devised an improved magnetic resonance imaging apparatus including imaging means for applying high-frequency magnetic fields and gradient magnetic fields to an object to be placed in a static magnetic field in accordance with a pulse sequence of dynamic measurement for continuously obtaining a plurality of time-series images and for measuring NMR signals emitted from the object to be examined. The imaging means is provided with a monitoring mode in which a desired slab of the object to be examined is measured using a pulse sequence for the dynamic measurement under a condition of applying gradient magnetic fields with a low spatial resolution and a substantial measurement mode in which the same slab is

measured using the same pulse sequence under a condition of applying gradient magnetic fields with a high spatial resolution. Each of independent claims 1 and 9 addresses these features, as well as additional features.

In the subject matter of claim 1, the dynamic measurement performed by the imaging means is blood imaging for observing a change of blood flow using a contrast agent, and the slice encode is omitted in the monitoring mode to obtain two-dimensional images and the slice encode is added in the monitoring mode to obtain three-dimensional images.

In the subject matter of claim 9, the gradient magnetic fields include a slice encode, a phase encode and a frequency encode for the two-dimensional or three dimensional measurement, and under the condition of applying gradient magnetic fields with low spatial resolution one of the slice encode and the phase encode is omitted and under the condition of applying gradient magnetic fields with high spatial resolution both of the slice encode and the phase encode is imparted.

The cited art does not teach or suggest such features.

Kaufman, as understood by Applicant, proposes an MRI system that switches between a fast imaging fluoro mode and a diagnostic imaging mode. The fluoro-mode is used to quickly obtain an image which provides confirmation that the selection of MR imaging parameters are proper and allows the user an opportunity to adjust these selections. After the selections have been confirmed and adjusted, the system is switched to a normal diagnostic image mode using the parameter selects as modified during fluoro-mode imaging.

Thus, in the system proposed by Kaufman, the fluoro-mode is performed to confirm whether the section of MR imaging parameters is proper. In contrast, the monitoring mode in the

subject matter of claims 1 and 9 of the present application is performed to determine the start time of the succeeding substantial measurement mode.

In addition, as acknowledged in the Office Action, Kaufman does not teach or suggest that the dynamic measurement performed by the imaging means is blood imaging for observing a change of blood flow using a contrast agent, and the slice encode is omitted in the monitoring mode to obtain two-dimensional images and the slice encode is added in the monitoring mode to obtain three-dimensional images, as provided by the subject matter of claim 1 as amended.

Further, although Kaufman proposes that the operator is allowed to select parameters for frequency encoding, phase encoding and slice encode, Kaufman does not teach or suggest that either under operator control or automatically, under the condition of applying gradient magnetic fields with low spatial resolution one of the slice encode and the phase encode is omitted and under the condition of applying gradient magnetic fields with high spatial resolution both of the slice encode and the phase encode is imparted, as provided by the subject matter of claim 9.

Geraats, as understood by Applicant, proposes an MRI method for acquiring data sets from respective scan-volumes of an object, wherein an explorative scan (for example, fluoroscopic scan of a thick slice) is employed to decide the appropriate moment for starting acquisition of data sets, either manually or automatically (based on comparison of the data from the explorative scan with a preselected reference.

Geraats, like Kaufman, does not teach or suggest that either under operator control or automatically, under the condition of applying gradient magnetic fields with low spatial resolution one of the slice encode and the phase encode is omitted and under the condition of

applying gradient magnetic fields with high spatial resolution both of the slice encode and the phase encode is imparted, as provided by the subject matter of claim 9.

For at least the above-stated reasons, Applicant respectfully submits that independent claim 9 and the claims depending therefrom are patentable over the cited art.

Regarding claim 1, although MRI system proposed in Geraats can be used for blood imaging to observe a change of blood flow using a contrast agent, Geraats, like Kaufman, does not teach or suggest that the slice encode is omitted in the monitoring mode to obtain two-dimensional images and the slice encode is added in the monitoring mode to obtain three-dimensional images, as provided by the subject matter of claim 1 as amended.

For at least the above-stated reasons, Applicant respectfully submits that independent claim 1 and the claims depending therefrom are patentable over the cited art.

In addition, in the subject matter of claim 6 of the present application, the pulse sequence used in the monitoring mode is the same as the substantial measurement mode, except the slice encoding. Accordingly, the data acquired in the monitoring mode can be used together with the data acquired in the substantial measurement mode to reconstruct images for diagnosis (claim 6 of the present application). Kaufman does not teach that the same pulse sequence is conducted in the fluoro-mode and the diagnostic mode. Applicant submits that one skilled in the art would understand the sequences in Kaufman to be different because the MR imaging parameters are varied in the fluoro-mode. In the subject matter of claim 6 of the present application, parameters are essentially not changed in the monitoring mode, except that the slice encode is omitted.

The Office Action cites Kaufman, col. 7, lines 39-49 and 57-58. However, Kaufman, col. 7, lines 39-49 and 57-58 does not teach or suggest that immediately after the substantial

measurement mode begins, images are reconstructed using data including data acquired in the pulse sequence performed previously, i.e., that data acquired in the monitoring mode is used together with data acquired in the substantial mode to reconstruct dynamic image.

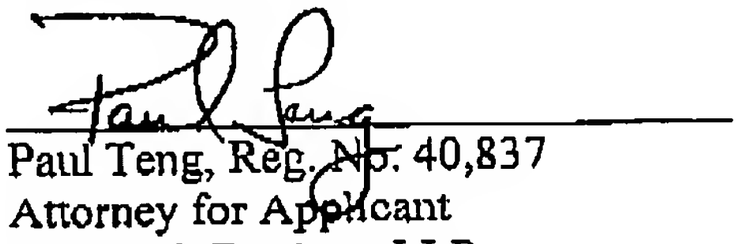
Regarding claim 4, the Office Action cites Kaufman, col. 8, lines 57-59. However, the Kaufman, col. 8, lines 57-59 teaches only that a smaller number of PE steps provides faster fluoro-imaging. Kaufman does not teach or suggest that a signal value of the origin of the k-space or an integration of data in the frequency encoding direction including the origin of the k-space is used as the reference data.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance, and earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,



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